

Application No.: 10/526,557

REMARKS

Reexamination and reconsideration of this application is respectfully requested in light of the amendment to claim 1 and the following remarks.

Claim 1 is pending in this application. Applicant notes the Examiner's consideration of the information cited in the Information Disclosure Statements filed March 4, 2005 and December 10, 2006, as acknowledged in the Office Action Summary. Applicant further notes the Examiner's acknowledgment of Applicant's claim for foreign priority under 35 U.S.C. § 119 and receipt of the certified priority document.

Rejection Under 35 U.S.C. § 112

Claim 1 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite because the claim contains multiple periods. The claim has been amended to delete the multiple periods. It is believed that the amendment obviates the objection. Accordingly, it is requested that the rejection be reconsidered and withdrawn.

Rejection Under 35 U.S.C. § 102

Claim 1 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Mais et al. (DE 4028269) or Mizusawa et al. (WO 97/43041). Mais et al. (DE 4028269) corresponds to EP 474074, which is cited as a prior art document in the present specification (see page 5, line 29 to page 6, line 26; and US 2006/0106264A1, paragraphs [0017] to [0019]). Mizusawa et al. is also cited in the present specification as a prior art document (page 6, line 27 to page 8, first line; U.S. Published Application No. 2006/0106264A1, paragraphs [0020] to [0022]). Particularly, Production Example 1 indicated by Office Action is described in paragraph [0022] of U.S. Published Application No. 2006/0106264A1. The difference between the present invention and

Application No.: 10/526,557

the subject matter of Mais et al. and Mizusawa et al. is fully explained in the specification, page 8, line 2 to page 10, line 10 (U.S. Published Application No. 2006/0106264A1, paragraphs [0023] to [0027]).

According to the Examiner, Mais et al. teach a process for the preparation of "dichlorobenzene" comprising "the chlorination of benzene or chlorobenzene in the presence of Friedel-Crafts catalysts and [a co-catalyst] N-[(perfluoroalkyl)carbonyl]phenothiazines ..." and that the "reactor was charged with benzene (100 parts by wt.), FeCl₃ or AlCl₃ (0.050 parts by wt.), N-(trifluoroacetyl)phenothiazine (0.091 parts by wt.)" The reaction produces 46.98% 1,4-dichlorobenzene or p-dichlorobenzene.

The Examiner appears to relying on Example 1 of Mais et al., which discloses the chlorination of benzene comprising the steps of mixing benzene in the presence of FeCl₃ and a co-catalyst, N-(trifluoro-acetyl)phenothiazine, heating the mixture to 60°C, and passing chlorine through the mixture for over 5 hours. The example, however, does not disclose the alternative use of FeCl₃ and AlCl₃ as inferred from the Office Action. A Comparative Example in the reference describes the same process as in Example 1, but substituting N-(trichloro-acetyl)phenothiazine for N-(trifluoroacetyl)phenothiazine. The reaction produced 40.48% of 1,4-dichlorobenzene.

It is acknowledged that Mais et al. disclose Lewis acids such as FeCl₃ and AlCl₃ as the Friedel-Crafts catalysts (page 2, lines 62 to 67), and sets forth that the ratio between the Friedel-Crafts catalyst and co-catalyst ranges from 10:1 to 1:10, preferably from 2:1 to 1:2 (claim 6). However, the only Friedel-Crafts catalyst used in Examples 1 to 6 of Mais et al. and in the Comparative Example 7 is FeCl₃. There are no examples in Mais et al. of using AlCl₃. Further,

Application No.: 10/526,557

there are no examples showing an unexpected increase in the yield of p-dichlorobenzene. For example, the yield of p-dichlorobenzene in Example 1 of Mais et al. is 33.56% (46.98%/1.4 [degree of chlorination]), but is 36.41% in Example 1 of the present invention (58.98%/1.62 [degree of chlorination]), a 8.5% increase in yield.

Further, Example 1 of Mais et al. merely describes that 1 mole of the co-catalyst is used with respect to 1 mole of FeCl_3 . Examples 2 to 6 of the reference also describe using not less than 1 mole of the co-catalyst with respect to 1 mole of FeCl_3 . No example in Mais et al. describes the use of 0.1 mole to 0.9 mole of N-[(perfluoroalkyl)-carbonyl]phenothiazines with respect to 1 mole of the Friedel-Crafts catalyst as required by claim 1.

For all of the foregoing reasons, the Examiner has not established a *prima facie* case of anticipation of claim 1 over Mais et al.

According to the Examiner, Mizusawa et al. teach "a process for the preparation of dichlorobenzene comprising Ph 10H-phenothiazine-10-carboxylates or their (optionally halogenated or alkyl-, alkoxy-, nitro- or cyano-substituted) chlorinated derivatives" and that "Lewis acids, such as FeCl_3 or AlCl_3 are useful as regioselective nuclear chlorinated catalysts for aromatic hydrocarbons." The Office Action cites Examples 1-16 of the reference and the abstract as reciting the chlorination of chlorobenzene by reacting chlorobenzene in the presence of a mixture of FeCl_3 and Ph 10H-phenothiazine-10-carboxylate for 7 hours at 50° C. In Example 1 of Mizusawa et al., the reaction produced 47.66% dichlorobenzene.

It is acknowledged that Mizusawa et al. disclose the regioselective chlorination of an aromatic compound using, as catalysts, Lewis acids such as FeCl_3 and AlCl_3 , and 10H-phenothiazine-10-carboxylic acid phenyl ester or their chlorinated derivatives. Contrary to the

Application No.: 10/526,557

holding of the Examiner, Production Example 1 of Mizusawa et al. does not describe that " AlCl_3 is used as the Lewis acid, and 0.1 mole to 0.9 mole of phenothiazine represented by Formula (I) is used with respect to 1 mole of AlCl_3 ". Also, contrary to the holding of the Examiner, Production Examples 2 to 16 of Mizusawa et al. do not describe (i) that " AlCl_3 " is used as the Lewis acid, and (ii) that "0.1 mole to 0.9 mole of phenothiazine represented by Formula (I) is used with respect to 1 mole of AlCl_3 ." Mizusawa et al. disclose mixing 0.3 milli-mole to 20 milli-moles (preferably from 0.6 milli-mole to 15 milli-moles, and more preferably 1 milli-mole to 10 milli-moles) of 10H-phenothiazine-10-carboxylic acid phenyl ester having Formula (I) with 1 milli-mole of the Lewis acid (page 9, lines 12 to 14). However, none of the examples in Mizusawa use AlCl_3 as the Lewis acid, let alone mixing 0.1 to 0.9 mols phenothiazine per mole of a Lewis acid. For example, Production Example 1 of Mizusawa et al. mixes 2.9 milli-moles of FeCl_3 and 14.7 milli-moles of 10H-phenothiazine-10-carboxylic acid phenyl ester. This corresponds to the use of 5.07 moles of 10H-phenothiazine-10-carboxylic acid phenyl ester with respect to 1 mole of FeCl_3 , which is outside the scope of the 0.1 to 0.9 mols range recited in claim 1.

The present invention is directed to using AlCl_3 as a Lewis acid, and that "0.1 mole to 0.9 mole of phenothiazine represented by Formula (I) is used with respect to 1 mole of AlCl_3 ." The use of AlCl_3 is not specifically disclosed or used in the production examples of Mizusawa et al. Further the reference does not disclose or suggest that AlCl_3 provides unexpected higher yields of p-dichlorobenzene. For example, the yield of p-dichlorobenzene in Example 1 of Mizusawa et al. is 32.20% (47.66%/1.48 [degree of chlorination]), whereas Example 1 of the present

Application No.: 10/526,557

invention) has a yield of 36.41% (58.98%/1.62 [degree of chlorination]), a 13.1% increase in yield.

For all of the foregoing reasons, the Examiner has not established a *prima facie* case of anticipation of claim 1 over Mizusawa et al.

In addition to the above, the present invention is the first to provide the advantage of a shorter chlorination reaction time than that of Mais et al. and Mizusawa et al. using 0.1 milli-mole to 3 milli-moles of aluminum chloride with respect to 1 mole of a benzene and/or chlorobenzene as the starting material with a degree of chlorination of 1.2 to 2.5. For example, the reaction time is 5.5 hours in Example 1 of Mais et al. and 5.5 hours in Production Example 2(A) of Mizusawa et al., whereas the reaction time of the present invention is 150 minutes or 2.5 hours as exemplified by Example 1 (regarding the chlorination of benzene) of the present invention. In addition, the present invention can realize the chlorination with para-selectivity equal to or higher than the conventional para-selectivity, despite of such a short reaction time. For example, the para-selectivity is 82.70% in Example 1 of Mais et al. and 86% in Production Example 2(A) of Mizusawa et al., but is 86.60% in Example 1 of the present invention.

Thus, neither Mais et al. nor Mizusawa et al. disclose nor suggest that AlCl_3 is better than FeCl_3 as a Lewis acid. Further, it cannot be predicted from the teachings of Mais et al. and Mizusawa et al. that "the use of 0.1 mole to 0.9 mole of phenothiazine represented by Formula (I) with respect to 1 mole of AlCl_3 " provides the excellent advantage of shortening the reaction time as compared with Mais et al. and Mizusawa et al. as well as providing a higher para-selectivity than conventional para-selectivity.

Application No.: 10/526,557

For all of the forgoing reasons, the Office Action has not presented a *prima facie* case of anticipation for the rejection of claim 1 over either Mais et al. or Mizusawa et al. The references do not disclose or suggest that the use of AlCl_3 would lead to shorter reaction times and higher yields of p-dichlorobenzene than that disclosed in the prior art. Accordingly, it is respectfully requested that the rejections of claim 1 as being anticipated by Mais et al. and Mizusawa et al. be reconsidered and withdrawn.

Conclusion

For the foregoing reasons, it is submitted that claim 1 is patentable over the teachings of the prior art relied upon by the Examiner and that the claim satisfies the requirement of the second paragraph of 35 U.S.C. § 112. Accordingly, favorable reconsideration of claim 1 is requested in light of the preceding amendment and remarks. Allowance of claim 1 is courteously solicited.

If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicant's attorney at the telephone number shown below.

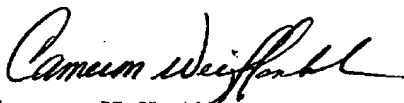
To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due under 37 C.F.R. § 1.17 and due in

Application No.: 10/526,557

connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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